

## INFLUENCE OF SUBSTRATE WATER CONTENT ON NEONATE SIZE IN THE PRAIRIE SKINK, *EUMECES SEPTENTRIONALIS*

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**ABSTRACT.**—The microenvironment of the nest surrounding most reptilian eggs is known to have a strong influence on the growth and development of embryos. This is particularly true of substrate moisture content. The results of this study suggest that neonatal body size (SVL) increases with increasing substrate wetness in the prairie skink, *Eumeces septentrionalis*. These results agree with studies conducted on other species of reptiles. This study is the first to provide evidence for this relationship in a scincid lizard.

The successful development of reptilian eggs is strongly influenced by their surrounding microenvironment (Packard et al. 1977, 1982, Ackerman et al. 1985, Gutzke and Packard 1987, Packard and Packard 1988). Unlike avian eggs, which experience a net loss of water as incubation progresses (Rahn and Ar 1974), the flexible-shelled eggs of many reptiles experience a net gain in water uptake during normal growth and development (Packard et al. 1982, Tracy 1982, Ackerman et al. 1985).

This study determined the influence of substrate water content on the size (SVL) of hatchling prairie skinks, *Eumeces septentrionalis*. The life history of *E. septentrionalis* has been summarized by various authors (Breckenridge 1943, Nelson 1963, Somma 1985, 1987a, 1987b, 1987c). Data presented herein represent measurements obtained from hatchlings that survived a study determining the effects of soil moisture on egg mortality (Somma and Fawcett, in press).

### MATERIALS AND METHODS

During May and June 1984, 18 gravid female *E. septentrionalis* were collected from Douglas and Pawnee counties in eastern Nebraska, USA. The skinks were housed separately in 26 × 16 × 13-cm plastic terraria containing 600 g (dry mass) of loam (42.2% sand, 44.6% silt, 13.0% clay) obtained from a natural nest site in Douglas County. Lamps suspended above the terraria provided a 14L:10D photothermal cycle. Temperature at

the substrate surface cycled from 26 C at night to 34 C during the day. (Methods are also detailed in Somma 1987b, 1987c, Somma and Fawcett, in press).

The soil moisture was maintained, using distilled water, within a range of 15–20% by mass in each terrarium. This range was maintained until the skinks oviposited and their eggs were assigned to a treatment group.

The females oviposited 18–30 June in nest cavities constructed in the substrate. The mean clutch size for *E. septentrionalis* in these populations is  $10.95 \pm 0.85$  (range = 4–18) (Somma 1987b). After each female had oviposited her clutch, the eggs were removed, individually candled, and determined to be viable. The eggs were returned to the nest cavities, and the clutches were assigned randomly to one of three soil moisture treatments: (1) dry, 5–10%; (2) medium, 15–20%; (3) wet, 25–30%. The treatment groups contained 71, 76, and 58 eggs, respectively.

### RESULTS

Egg mortality within each treatment was high and significantly influenced by substrate water content (Somma and Fawcett, in press), but it compared favorably with prenatal mortality rates found in natural lizard populations (Turner 1977). Emergence of surviving neonates occurred 14–23 July. Incubation time was 20–22 days (dry), 21–22 days (medium), and 23 days (wet). SVL measurement was taken from each neonate. Weights were not obtained because several neonates had already

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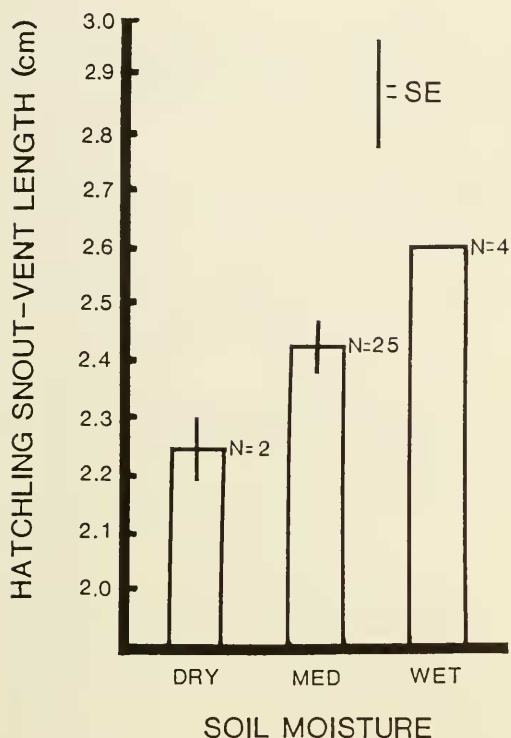


Fig. 1. Effect of substrate water content on neonatal *Eumeces septentrionalis* SVL. Bars represent the means; lines represent  $\pm$  one standard error of the mean. N = number of neonates. Standard error = 0.00 for the wet treatment.

lost their tails through aggressive interactions with nestmates; these tails were subsequently eaten by the aggressors. A one-way ANOVA (Sokal and Rohlf 1981) of the effect of substrate moisture content on mean neonate SVL was highly significant ( $F = 18.58$ , corrected  $df = 30$ ,  $P < .0002$ ) (Fig. 1). Neonate SVL in *E. septentrionalis* increases with an increase in substrate water content (Fig. 1).

#### DISCUSSION

The substrate water content is currently recognized as a critical factor in limiting the development and successful hatching of flexible-shelled reptile eggs (Packard et al. 1982, Packard and Packard 1988). Research indicates that water exchange may occur through (1) liquid water exchange between the eggshell and the substrate and (2) water vapor exchange between eggshell and the nest at-

mosphere (Muth 1981, Packard et al. 1982, Ackerman et al. 1985, Thompson 1987). The results of this study compare favorably with others demonstrating that eggs incubated on successively wetter substrates give rise to larger hatchlings in turtles (Packard et al. 1982, Morris et al. 1983), snakes (Black et al. 1984, Gutzke and Packard 1987), and iguanid lizards (Gordon 1960, Packard et al. 1982, Tracy and Snell 1985). These data are the first to suggest this effect on neonate scincid lizards. Further studies utilizing larger sample sizes are required to more clearly demonstrate this effect.

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